A High Transmission Analyzing Magnet for Intense High Charge State Beams

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The low energy beam transport (LEBT) for VENUS will provide for extraction, mass analysis and transport to the axial injection line for the 88-Inch Cyclotron. The new LEBT was designed from the beginning to handle high intensity beams where space charge forces strongly affect the transmission. The two main design goals were to first provide good resolving power and matching into the Cyclotron injection line and second to produce a high intensity beam with small emittance that matches the baseline requirements for the RIA (Rare Isotope Accelerator) driver linac. The test beam for the simulations was an U^{30+} beam at 6 pμA, which has a wide range of ion charge states and a proton equivalent intensity of 25 mA. The new LEBT uses a Glaser lens to match the beam into a large aperture double-focusing 90-degree analyzing magnet. The magnet has a unique design with specially shaped poles to apply sextupole correction in both the horizontal and vertical plane. Simulations which model emittance growth caused by space charge and beam extraction from a strong solenoidal field were also performed for the existing AECR-U LEBT. A comparison of the calculated and measured emittances for the AECR-U LEBT indicates that the effective radius of extraction is charge state dependent.

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